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V-22 Osprey Tilt-Rotor Aircraft

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V-22 Osprey Tilt-Rotor Aircraft

SUMMARY

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies like a plane by tilting its wing-mounted rotors to function as propellers. Combining a helicopter's operational flexibility with the greater speed, range, and efficiency of fixed-wing aircraft, the V-22 can perform such missions as troop/cargo transport, amphibious assault, special operations, and search and rescue operations.

Begun in FY1982 by the Army and now funded in part by the Air Force, the V-22 has been primarily a Marine Corps program funded by the Navy Department. The aircraft is produced by Bell Helicopter Textron and Boeing Helicopters, with engines produced by Rolls-Royce/Allison. Flight testing and operational evaluation of pre-production V-22s began in early 1997, with procurement of production aircraft approved in April 1997.

The future of the aircraft was at issue in 1989-92, when Secretary of Defense Cheney sought to cancel the program on grounds of affordability. Congress continued to fund the program, however, and through FY2000 some \$10 billion was provided for the program, which as of December 31, 1999, was estimated by the Defense Department to cost some \$38.1 billion to develop and produce 458 aircraft.

For FY2000, the Administration requested some \$1,100 million in Navy and Air Force procurement funds and Navy R&D funding for 10 aircraft. Congress authorized and appropriated funding for 12 MV-22s for the U.S. Marine Corps in FY2000. For FY2001, the Administration requested \$1,843 million for the program, including procurement funds for 16 MV-22s and 4 Air Force CV-22s.

The Administration's FY2002 defense budget requested \$3,278.3 million for the V-22 program including procurement of 12 MV-22s for the Marine Corps, modification of existing aircraft, and RDT&E.

Congress has supported the V-22 as a new technology with multi-service military applications as well as various civilian uses (if derivatives of this tilt-rotor aircraft are developed for civil aviation) with potential commercial and foreign sales implications. Critics of the V-22 have questioned its affordability and argued that its performance would not justify the cost of procuring this new aircraft in the quantity projected. Also, in light of several accidents, critics argue that the tilt-rotor technology is too risky, while supporters contend that risks are being adequately addressed.

MOST RECENT DEVELOPMENTS

In a December 21, 2001 memo to the Secretaries of the Air Force and the Navy, and the Commander-in-Chief, Special Operations Command, Undersecretary of Defense Edward "Pete" Aldridge gave his authorization for the V-22 to resume flight testing in the April 2002 time frame.

FY2002 authorization conferees cut \$50 million from the Navy's procurement request, providing enough funding for 11 airframes vs the 12 requested. House authorizers matched the Administration's request, Senate authorizers had cut \$226.7 million to procure nine airframes. Conferees rejected the Administration's request for Air Force procurement funding, reduced the Navy's request for R&D funding by \$100 million, and matched the Air Force's request for \$10 million in R&D funding.

FY2002 appropriation conferees cut the Navy's procurement request by \$226 million, a reduction of three airframes. Like authorizers, appropriators rejected the Administration's request for Air Force procurement funding. However, appropriators increased Air Force R&D funding by \$180 million to produce 2 CV-22 EMD articles. \$100 million was cut from the Navy's R&D request.

BACKGROUND AND ANALYSIS

Background

The U.S. Marine Corps considers the V-22 its highest aviation priority. Lt. Gen. Frederick McCorkle, The Marine Corps Deputy Commandant for Aviation has written “The Osprey’s introduction to the Marine forces is of paramount importance to the Marine Corps as it epitomizes our philosophy of procuring and fielding leap-ahead, advanced technology systems to best employ our expeditionary forces.” The Marine Corps believes that the Osprey will give them an unprecedented capability to quickly and decisively project power from well over the horizon. Indeed, the Marine Corps considers the V-22 Osprey more than just an aircraft. Instead, the Osprey is an important foundation upon which its vision for projecting naval power ashore (operational maneuver from the sea, or OMFTS) rests.

The V-22 tilt-rotor design combines the helicopter’s operational flexibility of vertical take off and landing with the greater speed, range, and fuel efficiency of a turboprop aircraft. The V-22 Osprey takes off and lands vertically like a helicopter but flies like a fixed-wing aircraft by tilting its wing-mounted rotors 90 degrees forward to function as propellers. This “...combination of increased payload with vastly improved speed and range,” McCorkle writes, “make the Osprey the aircraft that defines the commander’s area of influence as it relates to placing Marines on the ground.”¹

The V-22 can perform a variety of Army, Navy/Marine Corps, and Air Force missions, including troop and equipment transport, amphibious assault, search and rescue, and special

¹ McCorkle, Lt. Gen. Frederick. Transforming Marine Aviation. *Marine Corps Gazette*. May 2000:26.

operations. The Marines' MV-22 version can transport 24 fully-equipped troops some 200 nautical miles (nmi) at a speed of 250 knots (288 mi/h), exceeding the performance of the CH-46 medium-lift assault helicopters the MV-22 will replace. The Navy's HV-22 version will replace HH-3 helicopters now used for search and rescue. The Air Force's CV-22 version (with a range of 500 nmi) will be used for special operations. Army officials have testified that the service has no requirement for the V-22, but the Air Force has expressed strong interest in the CV-22 for its Special Operations Command, which plans to buy at least 50 CV-22s, beginning with four aircraft in FY2001. The Air Force's Special Operations Command CV-22s would begin operational service in September 2004 as planned in 1999. However, cost growth and production schedule delays may slowdown delivery of the CV-22, from nine aircraft per year to six per year. This slowdown would stretch out delivery of the CV-22 2009 to 2010 and delay initial operational capability by approximately six months.²

Developed and produced by Bell Helicopter Textron of Fort Worth, TX, and Boeing Helicopters of Philadelphia, PA, the aircraft is powered by two T406 turboshaft engines produced by Allison Engine Company of Indianapolis, IN, a subsidiary of Rolls-Royce North America. The contractors announced in August 1998 that the V-22 will be assembled in a new plant in Amarillo, TX.

Through FY2000, some \$10 billion was provided for the V-22 program, for which the Defense Department's Selected Acquisition Report of September 30, 2000, estimated the total acquisition cost of a 458-aircraft program at \$38.1 billion then-year dollars, which equates to a program acquisition unit cost of \$83 million then-year dollars. Then-year dollars refer to actual funding in prior years and projected funding in future years. The program acquisition cost includes funding for both development and production of the aircraft and related activities, whereas procurement or flyaway cost excludes research-development cost, thus making such estimates significantly lower than estimates of total program acquisition cost. Estimates in constant dollars are also lower than estimates in current or then-year dollars, which include both actual past costs and projected future costs, which are necessarily conjectural.

The V-22 program has proved controversial. Former Secretary of Defense Cheney tried to terminate the program in 1989-92, for instance, but Congress continued to provide funds for development of the V-22. The Bush Administration's FY1990 budget requested no funds for the program. In submitting this budget to Congress on April 25, 1989, Defense Secretary Cheney told the House Armed Services Committee that he "could not justify spending the amount of money ... proposed ... when we were just getting ready to move into procurement on the V-22 to perform a very narrow mission that I think can be performed ... by using helicopters instead of the V-22."

Program Details

In 1989, the Defense Department projected a 663-aircraft program, with six prototypes and 657 production aircraft (552 MV-22s, 55 CV-22s, and 50 HV-22s). As projected in

² Hebert, Adam. Three-year CV-22 Delivery Extension will Mean a Six-Month Delay. *Inside the Air Force*. September 8, 2000.

1994, however, the program comprised 523 production aircraft (425 MV-22s, 50 CV-22s, and 48 HV-22s). Procurement of these 523 aircraft was to continue into the 2020s, since the Defense Acquisition Board limited annual expenditures for Marine MV-22s to \$1 billion (FY1994 dollars) when it approved entry into engineering and manufacturing development (EMD) in September 1994. The Quadrennial Defense Review (QDR), released May 19, 1997, recommended accelerated procurement of 458 production aircraft (360 MV-22s for the Marines; 50 Air Force CV-22s; and 48 Navy HV-22s). Such a 458-aircraft program is now projected, with procurement of 16 aircraft in FY2001.³

The V-22 is based on the XV-15 tilt-rotor prototype which was developed by Bell Helicopter and first flown in 1977. The Department of Defense began the V-22 program in 1981, first under Army leadership but with the Navy/Marine Corps later taking the lead in developing what was then known as the JVX (joint-service vertical take-off/landing experimental aircraft). Full-scale development of the V-22 tilt-rotor aircraft began in 1986.

On March 19, 1989, the first of six MV-22 prototypes was flown in the helicopter mode and on September 14, 1989 as a fixed-wing plane. Two of these aircraft were destroyed in crashes. Prototype aircraft numbers three and four successfully completed the Osprey's first Sea Trials on the USS Wasp (LHD-1) in December 1990. The fifth prototype crashed on its first flight (June 11, 1991), because of incorrect wiring in a flight-control system; the fourth prototype crashed on July 20, 1992, while landing at Quantico Marine Corps Air Station, VA, resulting in loss of the aircraft and crew. This accident was caused by a fire resulting from component failures and design problems in the engine nacelles.

Flight tests were resumed in August 1993 after changes were incorporated in the prototypes. Flight testing of four full-scale development V-22s began in early 1997, when the first pre-production V-22 was delivered to the Naval Air Warfare Test Center in Patuxent River, MD. The first EMD Flight took place on February 5, 1997. The first of four low-rate initial production aircraft, ordered on April 28, 1997, was delivered on May 27, 1999. Osprey number 10 completed the program's second Sea Trials, this time from the USS Saipan (LHA-2) in January 1999.

Operational evaluation (OPEVAL) testing of the MV-22 began in October 1999 and concluded in August 2000. On October 13, 2000, the Department of the Navy announced that the MV-22 had been judged operationally effective and suitable for land-based operations. This finding moves the program one step closer to full-rate production, but a similar judgment is still required for ship-based operations. The Navy's Operational Test and Evaluation Command reported that the Osprey had yet to conduct more tests to demonstrate the MV-22's wing-folding mechanism. On November 15, 2000 the Marine Corps announced that the Osprey had successfully completed sea trials and had been deemed operationally effective and suitable for both land- and sea-based operations.

The V-22 Program Office – led by Marine Corps Colonel Dan Shultz and staffed by acquisition professionals from the Marine Corps, the Navy and the Air Force – reports the

³ The Navy plans to purchase 19 MV-22s in FY02, and 28 in years FY03, 04, and 05. Some in the Marines, such as budget chief LtGen William Nyland advocate a buy of 36 per year to accelerate the program and to reduce overall program costs.

following flight test accomplishments: More than 2500 hours flown (over 1300 hours on EMD aircraft). Achieved speeds of 342 knots (402 mph); altitude of 25,000 ft; gross weight of 60,500 lbs., and a G maneuver load factor of +3.9 at 260 knots. External loads of 10,000 lbs have been carried at 230 knots. The Program Office reports that the MV-22 has flown more than 40 troop-lift missions and has carried more than 700 troops during OPEVAL flights. Other tests conducted during OPEVAL included land and ship-board operations, amphibious assault missions, over-water operations, night-vision goggle flights, low-level navigation, external load lifting on single and dual hooks, in-flight refueling with a C-130 tanker, and landings in difficult terrain.

Successfully completing OPEVAL should clear the way for full rate production of 28 aircraft a year, although the Marines would prefer a rate of 36 annually. This decision was to have been made in December 2000, but has been postponed indefinitely, due to two recent fatal crashes and a mixed report from DoD's director of operational test and evaluation.

On April 8, 2000 another Osprey crashed near Tucson, Arizona during an exercise simulating a noncombatant evacuation operation. All four crew members and 15 passengers died in the crash. An investigation of the accident found that the pilot was descending at or in excess of the recommended flight envelope which may have caused the aircraft to experience an environmental condition known as "power settling" or "vortex ring state." According to Lt. Gen. Fred McCorkle, the pilot was descending more than a thousand feet per minute. The recommended descent rate is 800 feet per minutes." Following a two-month suspension of flight testing, the Osprey recommenced OPEVAL in June 2000, with pilots flying a slightly tighter flight envelope. A July 27, 2000 report by the Marine Corps Judge Advocate General (JAG) confirmed that a combination of "human factors" caused the crash.

"This mishap appears not to be the result of any design, material or maintenance factor specific to tilt-rotors. Its primary cause, that of a MV-22 entering a Vortex Ring State (Power Settling) and/or blade stall condition is not peculiar to tilt rotors. The contributing factors to the mishap, a steep approach with a high rate of descent and slow airspeed, poor aircrew coordination and diminished situational awareness are also not particular to tilt rotors."⁴

It was reported on June 28, 2000 that a draft DoD Inspector General study concluded that the V-22 would not successfully demonstrate 23 major operational effectiveness and suitability requirements prior to the December 2000 OPEVAL Milestone III decision to enter full rate production in June 2001. The Marine Corps agreed with DoD's assessment of the deficiencies, but said that they have been aware of these deficiencies before the beginning of OPEVAL. Furthermore, the Marine Corps said that they have an approved plan designed to resolve the deficiencies prior to the Milestone III decision.

On November 17, 2000, DoD's Director of Operational Test and Evaluation issued a mixed report on the Osprey; saying although "operationally effective" the V-22 was not "operationally suitable, primarily because of reliability, maintainability, availability, human factors and interoperability issues." The report recommended that more research should be

⁴ V-22 JAGMAN Executive Summary. United States Marine Corps. Division of Public Affairs. July 27, 2000:1

conducted into the V-22's susceptibility to the vortex ring state blamed for the April 8, 2000 crash.

On December 11, 2000, a MV-22 Osprey crashed near Jacksonville, NC, killing all four Marines on board. This was the fourth Osprey crash since 1991 and the third lethal accident. The aircraft's pilot, LtCol. Keith M. Sweeney was the program's most experienced pilot and was in line to command the first squadron of Ospreys. The aircraft's copilot, Maj. Michael Murphy was second only to Sweeney in flying time on the Osprey.⁵ The Marine Corps has grounded the Osprey fleet pending a mishap board investigation. On April 5, 2001, the Marine Corps reported that the crash was caused by a burst hydraulic line in one of the Osprey's two engine casings, and a software malfunction that caused the aircraft to accelerate and decelerate unpredictably and violently when the pilots tried to compensate for the hydraulic failure.⁶ The Marine Corps report called for a redesign of both the hydraulics and software systems involved. Estimates for how long such a redesign would take, range from three months to two years.⁷

In December 2000, an anonymous letter was mailed to the media by someone claiming to be a mechanic in the Osprey program. The letter claims that V-22 maintenance records had been falsified for two years, at the explicit direction of the squadron commander. The letter claimed that an accompanying audio tape was a surreptitious recording of the squadron commander directing maintenance personnel to lie about the aircraft until the V-22 LRIP decision was made. On January 20, 2001 it was reported that the V-22 squadron commander admitted to falsifying maintenance records. The Marine Corps subsequently relieved him of command and reassigned him to a different position. The Department of Defense's Inspector General (IG) is conducting an investigation. On September 15, 2001, it was reported that three Marines were found guilty of misconduct and two were reprimanded for their actions.

On April 19, 2001, a Blue Ribbon panel formed by then-Secretary of Defense William Cohen to review all aspects of the V-22 program, reported its findings and recommendations.⁸ These findings and recommendations were also discussed during congressional testimony on May 1, 2001. The panel recommended that the program continue, albeit in a restructured format. The panel concluded that there were numerous problems with the V-22 program, but nothing inherently flawed in the aircraft design. Because of numerous safety, training and reliability problems, the V-22 is not maintainable, or ready for operational use.

⁵ Dao, James. Marines Ground Osprey Fleet After Crash Kills Four. *New York Times*. December 12, 2000.

⁶ An un-redacted version of JAG investigation into the April 2000 V-22 crash indicates that investigators found three "noteworthy" maintenance "areas of concern", including the Osprey's hydraulics system. A Naval Safety Center presentation to the Blue Ribbon Panel brought to light several previously unreported maintenance problems – including hydraulics failures – that caused engine fires or other problems during the Osprey's operational testing.

⁷ Flaherty, Mary Pat. Osprey Crash Blamed on Leak, Software. *Washington Post*. April 6, 2001.

⁸ This panel is chaired by retired Marine General John R. Dailey and includes retired Air Force General James B. Davis, Norman Augustine, and MIT professor Eugene Covert.

The panel recommended cutting production to the “bare minimum” while an array of tests are carried out to fix a long list of problems they identified with hardware, software and performance. Program officials estimate that the minimal sustainable production rate is 12 aircraft per year, which would be less than half the Ospreys once planned for FY2002.⁹ Cutting near term production should free up funds to pay for fixes and modifications. Once the changes have been made and the aircraft is ready for operational use, the Panel suggested that V-22 out year purchases could be made in large lots using multi year contracts to lower acquisition costs.

DoD appears to be taking managerial and budgetary steps to incorporate the Blue Ribbon Panel’s recommendations. DoD’s FY2001 supplemental funding request asked for a reduction of \$475 million in procurement and an increase of \$80 million in R&D funds. The additional R&D funding would be used to support initial redesign and testing efforts to address deficiencies, logistics, flight test and flight test support for V-22 aircraft. The reduction in procurement funding reflects the need to reduce production to the minimum rate while the aircraft design changes are being developed and tested.

Secretary of Defense Rumsfeld’s FY02 budget amendment, unveiled June 27, 2001, included a request for the procurement of 12 Ospreys. DoD comptroller Dov Zakheim and Marine Corps Commandant Gen. James Jones both stated that the procurement of 12 aircraft in FY2002 would allow them to sustain the V-22 subcontractor base while simultaneously addressing the Osprey program’s needs.¹⁰ Although DoD had not yet released specific budget figures, the media reported that DoD requested \$1.14 billion to procure the 12 V-22s in FY2002.¹¹

Following the Blue Ribbon panel’s recommendations, it was reported that DoD Under Secretary for Acquisition Edward “Pete” Aldridge assumed acquisition authority for the V-22 program. Under Secretary Aldridge changed the V-22 program’s status from an ACAT 1C program – which gives the Department of the Navy the highest required authority for production decisions – to an ACAT 1D program. The Defense Acquisition Board (DAB) will now decide if and when the program is ready to enter full rate production. Other ACAT 1D programs, for example, include the F-22 Raptor and the RAH-66 Comanche.¹²

Navy officials say they are considering a series of block upgrades to the Osprey to get the program back on track. These upgrades may combine up to 120 “fixes” identified by DoD. Although purchases of the CV-22 variant have been postponed until the program is

⁹ Hebert, Adam. Minimal Sustainable Rate Will Dramatically Cut Near-Term V-22 Buys. *Inside the Air Force*. April 20, 2001.

¹⁰ DoD News Briefing, Wednesday June 27, 2001 1:30PM. and Gildea, Kerry, “New V-22 Plan Sustains Lower Tier Contractors, Jones Reports.” *Defense Daily*. May 15, 2001.

¹¹ Whittle, Richard, “Budget Benefits Texas: Pentagon Keeps funds for V-22 and F-22 Aircraft.” *Dallas Morning News*, June 28, 2001.

¹² “Navy Loses Osprey Authority. *Washington Post*. May 22, 2001. and Keeter, Hunter. “Aldridge Maneuvers V-22 Acquisition Authority Away from Navy,” *Defense Daily*, May 22, 2001. and de France, Linda. “V-22 Osprey Production Authority Transferred from Navy to DoD. *Aerospace Daily*. May 22, 2001.

restructured, Air Force Special Operations Command officials have said that they are developing plans to accelerate future buys once the program is back on track. In October 2001, it was reported that Undersecretary Aldridge estimated that the V-22 would require at least two years of flight testing before DoD could conclude that the aircraft is safe, effective, and “worth the cost.”¹³

A NASA-led review of the V-22 program, released November 6, 2001, formally endorsed resuming flights of the aircraft as soon as possible. The study concluded that there are no known aero-mechanical phenomena that would stop the tilt rotor’s development and deployment. The study focused on several aero-mechanics issues, including Vortex Ring State, power problems, auto-rotation, and hover performance.¹⁴

In a December 21, 2001 memo to the Secretaries of the Air Force and the Navy, and the Commander-in-Chief, Special Operations Command, Undersecretary of Defense Edward “Pete” Aldridge gave his authorization for the V-22 to resume flight testing in the April 2002 time frame. Secretary Aldridge expressed support for range, speed and survivability goals of the V-22. He noted, however that the program still had numerous technical challenges to overcome, and emphasized that the V-22 must demonstrate that “1) it can meet the needs of the warfighter better than any other alternative, 2) it can be made to be reliable, safe, and operational suitable, and 3) it is worth its costs in contributing to the combat capability of U.S. forces.” Secretary Aldridge approved the flight test program under the condition that the production rate be slowed to the minimum sustaining level, that it be comprehensive and rigorous, and that the restructured program is fully funded in accordance with current estimates.¹⁵

System Description

The V-22 is a tilt-rotor V/STOL aircraft, capable of vertical or short take off and landing, with forward flight like a conventional fixed-wing aircraft. About 65% of the airframe is made of graphite-epoxy composite materials. The Marine Corps’s MV-22 version will have the following characteristics:

Propulsion	2 T406 turboshaft engines
Crew	3
Passengers	24 combat troops
Max. vertical take off weight	47,500 lb
Max. short take off weight	55,000 lb
Speed at max. weight	250 nmi/hour
Combat radius	200+ nmi

¹³ Capaccio, Tony. “Textron-Boeing V-22 Needs Two years of Testing, Aldridge Says.” *Bloomberg.com*. October 16, 2001.

¹⁴ Castelli, Christopher. NASA Review Panel Endorses Resumption of V-22 Flight Tests. *InsideDefense.com*. November 14, 2001.

¹⁵ Text: Aldridge Memo on V-22. *Inside the Navy*, January 7, 2002.

The airframes of the Marine Corps MV-22 and the Air Force CV-22 variant for Special Operations Command will have some 90% commonality. The CV-22 will carry 18 troops, with auxiliary fuel tanks increasing combat radius to about 500 miles. This variant may carry a 50-cal GAU-19 nosegun. The Air Force will initiate a study in the spring of 2001 to determine the efficacy of adding a gun.¹⁶ The CV-22 will also carry advanced avionics that will allow special operations forces to penetrate hostile areas in all weather and terrain.

The V-22's potential capabilities relative to conventional helicopters and turboprop aircraft are illustrated by two figures found on the USMC V-22 Website [<http://www.navair.navy.mil/v22/>]. The V-22 has the ability to carry considerably larger payloads much greater distances than CH-46 helicopter that it will replace. The V-22 could carry three times the payload, or fly five times the range of the CH-46. While it will take off and land vertically like a helicopter, the V-22 will fly twice as fast. While the V-22's range, speed and payload capabilities are most frequently touted, the Bell/Boeing contractor team reports the Osprey exhibits the following survivability traits: The V-22 is up to 21 times less vulnerable to small arms fire than current helicopters, it is 75 percent quieter than helicopters, and it is the only U.S. tactical transport aircraft with designed-in nuclear, biological and chemical warfare protection.

Figure 1. V-22 Osprey in Flight



Key Issues

Should the Defense Department Procure the V-22 Aircraft?

Main arguments of those who say “Yes”. The Defense Department should accelerate procurement of the V-22, which the Marine Corps considers its most important aviation program, in order to obtain these aircraft sooner and at more economical production rates. The V-22 is needed to replace aging military helicopters in all the services, which are costly to maintain and operate safely and effectively. The Army should reconsider its decision not to buy the V-22, which the Air Force wants to procure for its Special Operations

¹⁶ Hebert, Adam. Decision on Whether CV-22 will Feature a Gun awaits Vibration Study. *Inside the Air Force*. October 20, 2000.

missions. The Osprey represents a truly joint capability, as evidenced by the Navy's desire to purchase HV-22s for search and rescue, and other missions. This tilt-rotor aircraft will provide the operational flexibility of a helicopter without the helicopter's inherent limitations of speed, range, and altitude. When landing on hostile shores in a third-world conflict, the V-22 would be critical for the transport of Marines from ship to shore. The Osprey has been rigorously tested and its accident rate is consistent with other aircraft development programs. The development of tilt-rotor aircraft for the armed services will also have significant spin-off effects for civil aviation and U.S. technology, giving the U.S. aerospace industry a major competitive advantage in the international market.

Supporters of the V-22 also cite the tilt-rotor's potential value for civil aviation, law enforcement, and foreign sales by the U.S. aerospace industry. (Congressional Record, April 19, 1989: S4507-S4509). A February 1988 study by the FAA and NASA concluded that tilt-rotors could help relieve airport congestion by diverting commuters and short-distance passengers to vertiports in urban centers. The importance of U.S. production of a tilt-rotor aircraft for civilian purposes was the subject of a hearing on July 17, 1990, by the House Committee on Science, Space, and Technology's Subcommittee on Transportation, Aviation, and Materials. In 1992, Congress enacted legislation (H.R. 6168) directing the Secretary of Transportation to establish a "civil tiltrotor development advisory committee" to evaluate the feasibility and viability of developing civil tilt-rotor aircraft and infrastructure necessary to incorporate tilt-rotor aircraft into the national transportation system. The role of tilt-rotor aircraft in civil aviation was also discussed on April 12, 1994, before the House Committee on Science, Space, and Technology's Subcommittee on Technology, Environment, and Aviation.¹⁷

Main arguments of those who say "No". The V-22 is unaffordable in the present budgetary environment, when the cost of buying large numbers of these transport/cargo aircraft would most likely be at the expense of more critical defense needs. Ship-to-shore logistical operations can be performed by less expensive helicopters for the kinds of landing operations in which the Marines are likely to be involved, where the V-22's greater speed and range would not be needed. Moreover, Marine assault missions in an opposed landing would involve ship-to-shore movement of troops and equipment, which would require coordination with aircraft having less speed and range than the V-22. As currently funded, the V-22 program is not the joint-service effort it was expected to be, despite Air Force use of the aircraft. Whatever commercial value a tilt-rotor aircraft might some day have for civil aviation, the V-22's value as a military system is insufficient to justify its cost in these times of budgetary constraints and higher priority defense needs. In light of several V-22 crashes, three involving fatalities, many would argue that the tilt-rotor technology is not sufficiently mature to merit the Osprey's production and fielding. Finally, January 12, 2001 presentation by the GAO to the V-22 Blue Ribbon Panel cast some doubts on the Osprey's operational capabilities and operational concepts. Specifically, the GAO said that the V-22's cabin may

¹⁷ In November 1996, Bell Helicopter Textron and Boeing announced plans to build a six-to-nine passenger civil tilt-rotor aircraft, designated the Bell-Boeing 609, which in 1998 was scheduled to be flight-tested in 2000. Bell-Boeing reported at the 1997 Paris air show that it had orders for 29 of these new aircraft, and by August 1998 there were 67 orders for the 609 from customers in 16 countries. In February 1998, Bell Helicopter Textron acquired full ownership of the 609 civil tilt-rotor program, with Boeing participating as a major subcontractor.

not be large enough to carry 24 combat-equipped Marines, and that the severe rotor down wash might impede the ability of troops to exit the aircraft and move into combat positions.

Congressional Action

The V-22 program was an issue in the 1992 presidential campaign, with Democratic candidates Clinton and Gore supporting development of the aircraft while the Bush Administration opposed the program until late October when Vice President Quayle announced a contract award to the development team. On October 22, 1992, the Navy awarded a \$550-million contract to the Bell-Boeing team to build four new V-22 derivatives and to modify two existing V-22 prototypes for evaluation of proposed design changes.

The Clinton Administration's FY1994 defense budget requested \$82.3 million for the V-22 program. The House authorized FY1994 funds for the V-22 as requested. The Senate authorized \$10 million (on grounds that unspent prior-year funds were adequate for the program in FY1994) and \$15 million for the CV-22 variant for special forces missions. House and Senate conferees agreed in November 1993 to authorize and appropriate \$10 million for the program.

The Administration's FY1995 budget request of \$496.9 million for the V-22 program was authorized by the House in the FY1995 defense authorizations bill (H.R. 4301, passed June 9, 1994) and by the Senate in its version of the authorizations bill (S. 2182, passed July 7, 1994). This figure was also contained in both the House version of the FY1995 defense appropriations bill (H.R. 4650, passed June 29, 1994) and the Senate version (passed August 11, 1994). House and Senate conferees reduced the FY1995 appropriation to \$466.9 million while reaffirming "their strong support for this unique aircraft." The conferees expect DOD "to provide sufficient long lead procurement funds in the FY1996 budget request to commence low rate initial production of the V-22 in FY1997....for a V-22 initial operational capability in FY2001." (H.Rept. 103-747, passed September 29, 1994).

The Administration's FY1996 budget requested \$810.6 million for the V-22 — \$762.6 million in R&D funds and \$48 million in advance procurement funds, to begin production in FY1997. The FY1996 budget projected a request of \$1,275.3 million for the V-22 program in FY1997, including \$692.8 million in procurement funds for production of four aircraft. The House authorized the \$810.6 million requested in its version of the FY1996 defense authorizations bill (H.R. 1530, passed June 15, 1995). The House National Security Committee noted in its report on H.R. 1530 that the current plan to procure 523 V-22s "over a period of twenty-seven years ... [would result] in a very low and inefficient production rate." The Committee directed DOD to report on options to reduce program costs and provide a more efficient production rate by submission of the FY1997 defense budget. (H.Rept. 104-131, p. 31.) The Senate version of the FY1996 defense authorizations bill (S. 1026, passed September 6, 1995) also authorized requested funds for the V-22.

In the FY1996 defense appropriations bill (H.R. 2126, passed September 7, 1995; S. 1087, passed September 5, 1995), the House approved requested funds for the program (H.Rept. 104-208), while the Senate provided some \$5 million less than was requested for the program without explaining the grounds for this reduction (S.Rept. 104-124). House and Senate conferees agreed to the Senate's lower figure of \$805.6 million in H.Rept. 104-261, which the House rejected on September 29, 1995, for reasons unrelated to the V-22 program.

FY1996 funds for the program were provided in a modified version of the conference report (H.Rept. 104-344) that the House and Senate passed on November 16, 1995 (P.L. 104-61, December 1, 1995). This amount was later authorized in a modified conference report on the FY1996 defense authorizations bill (H.Rept. 104-450) passed in January 1996 by the House (January 24, 1996) and Senate (January 26, 1996).

The Administration's FY1997 budget requested \$1,135.5 million for the V-22 program (\$558.7 for procurement of four aircraft and \$576.8 in R&D funds). During hearings on the FY1997 defense budget, supporters of the V-22 emphasized the need to accelerate procurement beyond the levels projected in the Administration's budget, arguing that this would reduce program costs over the long term and would get more aircraft in service sooner. Secretary of the Navy Dalton indicated that if more procurement funding were available, the Navy would buy six V-22s in FY1997 versus the four requested by the Administration.

In May 1996, both the House National Security Committee and the Senate Armed Services Committee recommended procurement of six V-22s in FY1997. The House version of the FY1997 defense authorizations bill (H.R. 3230, passed May 15, 1996) included \$1,414.5 million for the program (\$613.8, R&D; \$800.7, procurement). The Senate Armed Services Committee report (S.Rept. 104-267) noted that an increase of \$302 million for procurement of six aircraft in FY1997 and advance procurement funds for 12 in FY1998 "would result in a cost saving of \$32 million ... through fiscal 2001." The Committee also directed the program to make one Marine Corps MV-22 version available in 1999 for remanufacture as a CV-22 variant to be flight-tested by Special Operations Forces. The Senate bill (S. 1745, passed July 10, 1996) authorized \$1,506.5 million for the V-22 in FY1997. House and Senate conferees agreed to authorize \$1,474.5 million for the program in FY1997, with funding for procurement of the first six production V-22s (H.Rept. 104-724), passed by the House on August 1, 1996, and by the Senate on September 10, 1996.

The House version of the FY1997 defense appropriations bill (H.R. 3610, passed June 13, 1996) also provided \$1,474.5 million for the program, including funds for a 6-aircraft buy in FY1997 and advanced funding for 12 V-22s in FY1998. The House Appropriations Committee report (H.Rept. 104-617) directed "that the FY1998 and subsequent budgets ... continue the ramp-up [of the V-22 program] to reach an economic rate of 36 aircraft per year not later than FY2000." The Senate version of the bill (S. 1894, passed July 18, 1996) appropriated \$1,455.5 million for the program in FY1997, with procurement funds for six aircraft. House and Senate conferees agreed in September 1996 to appropriate \$1,325 million for the V-22 program in FY1997: \$749 million for procurement of five aircraft and \$577 million for R&D (H.Rept. 104-863).

The FY1998 defense budget requested \$1,071.2 million for the V-22 program (\$541.7 million for procurement of five aircraft and \$529.5 million in R&D funds), with projected funding of \$948.8 million in FY1999 (\$676.1 million in procurement and \$272.7 million in R&D funds). On June 25, 1997, the House authorized \$1,260.5 million in Navy procurement and R&D funds for seven aircraft, while the Senate authorized \$1,161.2 million in FY1998 procurement and R&D funds for six aircraft on July 11, 1997. The Senate Armed Services Committee stated that "Noting the constrained circumstances in the near and far term, the committee is still persuaded that an addition to the procurement of MV-22s will result in efficiencies and increased capabilities for deployed Marines." (S.Rept. 105-29: 69) On July

15, 1997, the Senate appropriated \$1,218.6 million for procurement of seven MV-22s vs. the five requested by the Administration. On July 29, 1997, the House appropriated funding as authorized by the House — \$1,260.5 million for procurement of seven MV-22s. The FY1998 defense appropriations conference report (H.Rept. 105-265), agreed to by Congress on September 25, 1997, and enacted as H.R. 2266/P.L. 105-56 on October 8, 1997, included the amount provided by the Senate — \$1,218.6 million for seven aircraft, which was also agreed to by conferees on the FY1998 defense authorizations bill (H.R. 1119) in H.Rept. 105-340, passed by the House on October 28 and the Senate on November 6, 1997.

The Administration's FY1998 budget projected procurement of five MV-22s in FY1998, with a buy of 24 in FY2003. Advocates of the V-22 viewed these procurement rates as inefficient and argued that such production rates would force the Marines to rely on aging and unreliable CH-46 helicopters. This view was reflected in the QDR's call for accelerated procurement of the MV-22 as well as in the actions of Congress, which authorized and appropriated funds for seven aircraft in FY1998 instead of the five requested.

The Administration's FY1999 defense budget requested \$1,042.2 million for the V-22 program: \$664.8 million in Navy procurement funds for seven MV-22s, \$22.3 million in Air Force procurement funds for advance procurement of the CV-22 version, and \$355.1 million in Navy R&D funding. The Senate version of the FY1999 defense authorizations bill (S. 2057; S.Rept. 105-189), passed on June 25, 1998, would fund the program as requested. The House version (H.R. 3616; H.Rept. 105-532), passed on May 21, 1998, authorized an additional funding for procurement of eight MV-22s but would not authorize the \$22.3 million in advance procurement funds for the CV-22, because "the Committee believes these funds can be deferred until FY2000." (H.Rept. 105-532: 61, 95-96.) House and Senate conferees agreed to authorize \$1,097.9 million, including R&D funds and advance procurement funds for the CV-22 as requested and funding for procurement of eight MV-22s (H.Rept. 105-736, September 22, 1998) in the conference report to accompany H.R. 3616, passed by the House, September 24, and by the Senate, October 1, and enacted as P.L. 105-261 on October 17, 1998.

The House version of the FY1999 defense appropriations bill (H.R. 4103; H.Rept. 105-591), passed on June 24, 1998, provided funding for an 8-aircraft program as authorized by the House. On July 30, 1998, the Senate passed its version of the FY1999 defense appropriations bill (S. 2132; S.Rept. 105-200), which appropriated funding for a 7-aircraft program as requested and authorized by the Senate. House and Senate conferees agreed to appropriate \$1,042.2 million in FY1999 development and procurement funding for seven MV-22s and the Air Force CV-22 version as requested by the Administration. (H.Rept. 105-746, September 25, 1998). The conference report on H.R. 4103, passed by the House on September 28 and by the Senate on September 29, 1998, was enacted as P.L. 105-262 on October 17, 1998.

The Administration's FY1999 budget requested funds for procurement of seven more MV-22s for the Marines and advance funding for the CV-22 version, to be procured by the Air Force beginning in FY2001. The FY1999 budget projected the following procurement plan: FY1999 — 7 MV-22s; FY2000 — 10 MV-22s; FY2001 — 16 MV-22s and four CV-22s; FY2002 — 20 MV-22s and six CV-22s; FY2003 — 27 MV-22s and nine CV-22s. The FY2000 budget projected annual buys of 30 MV-22s beginning in FY2003.

The Administration's FY2000 defense budget requested \$1,099.8 million for the V-22 program — \$867.4 million in Navy procurement funding for 10 MV-22s, \$49.5 million in Air Force advance procurement funding for the CV-22, and \$182.9 million in Navy R&D funding. The House version of the FY2000 defense authorizations bill (H.R. 1401), passed on June 10, 1999, approved procurement of 11 MV-22s; the Senate version of the bill (S. 1059), passed on May 27, 1999, authorized funds for procurement of 12 MV-22s. The House and Senate conferees agreed to a 12-plane buy, with an additional \$9 million in R&D funding; their conference report (H.Rept. 106-301) was passed by the House on September 15 and by the Senate on September 22, 1999, and enacted as P.L. 106-65, October 5, 1999. The Senate version of the FY2000 defense appropriations bill (S. 1122), passed on June 8, 1999, funded procurement of 12 MV-22s, as authorized by the Senate, and provided an additional \$9 million in R&D funds; the House version (H.R. 2561), passed on July 22, 1999, funded procurement of 11 MV-22s, as authorized by the House. House and Senate conferees agreed to fund a 12-plane buy in FY2000, and their conference report (H.Rept. 106-371), passed by the House on October 13 and by the Senate on October 14, 1999, enacted as P.L. 106-79, October 25, 1999, provided \$1,168.8 million for the program (\$976.9 million in procurement and \$191.9 million in R&D funding).

The Administration's FY2001 defense budget requested \$1,843.1 million for the V-22 program – \$1,314.9 million for procurement of 16 MV-22s for the Marine Corps, \$380 million for procurement of four CV-22 versions for the Air Force, and \$148.2 million in Navy R&D funding. In a February 9, 2000 letter to the House Armed Services Committee, the Marine Corps states that their first unfunded priority is the \$166 million procurement of two additional V-22s and spare parts, which would bring their total procurement to 18 aircraft. For FY2001 the House and Senate defense committees consistently supported the V-22 by recommending authorizations and appropriations that matched or slightly exceeded Administration's request. Defense appropriations (H.R. 4576) supported the program with only minor modifications – a \$4.5 million reduction in Force advanced procurement, current year. Additionally, authorization conferees required that "all V-22 Osprey aircraft be equipped with a state-of-the art cockpit voice recorder and a state-of the art flight data recorder..."(p.35, H.Rept. 106-945, H.R. 4205).

On February 7, 2001 Senator Russ Feingold introduced the "Osprey Safety, Performance and Reliability Evaluation Act of 2001." This bill would rescind all FY2001 procurement funding except for what is required to maintain the V-22 production base, and delay the program one year. The bill also requires a report to Congress by the Secretary of the Navy regarding steps taken to ameliorate concerns expressed by DoD's Director of Operational Test and Evaluation. It also requires a report to Congress by the DoD Inspector General on V-22 maintenance. Both reports must be submitted prior to the V-22 Milestone III decision. On March 5, 2001 Senator Feingold followed up this bill with a letter to Defense Secretary Donald Rumsfeld urging him to delay further procurement of the V-22 until all investigations into the program have been completed and until further testing has been completed to ensure that the Osprey is safe. Also, on April 24, 2001, Rep. Bob Filner introduced a bill that would mandate a one year moratorium on V-22 procurement.

Congressional defense oversight committees made modifications to DoD's FY2001 supplemental spending request. On June 20, 2001, the House passed H.R. 2216, Making Supplemental Appropriations for the Fiscal Year Ending September 30, 2001 and for Other Purposes. In this bill the House supported the general thrust of DoD's adjustment to the V-22

program, but recommended additional appropriations of \$40 million for Navy RDT&E (for a total of \$120 million) in order to accelerate activities associated with fixing the V-22 program, such as risk reduction, part redesign, and continued operational testing. Because it disagreed with DoD assumptions on V-22 pricing, the House recommended additional reductions in Navy and Air Force V-22 procurement of \$120 million (for a total revision of \$595 million).

The Senate Appropriations Committee Report (S.Rept. 107-33, to accompany S. 1077) supported DoD's request to add \$80 million to FY2001 V-22 RDT&E. Senate appropriators recommended a reduction of \$513 million in Navy and Air Force V-22 production, as opposed to the DoD request to rescind \$475 million in Navy and Air Force FY2001 production funds.

The Appropriations Conference Report (H.Rept. 107-148, H.R. 2216) Making Supplemental Appropriations for FY2001 concurred with the Senate appropriators desire to add \$80 million for only for the correction of deficiencies, flight testing and flight test support. Appropriations conferees approved a reduction of \$199 million for MV-22 procurement instead of the \$235 million reduction proposed by DoD. Conferees also approved revision of \$327.5 million from CV-22 procurement, delaying initial acquisition of this variant until deficiencies are corrected.

On August 1, 2001 the House Armed Services Committee (HASC) completed its markup of the FY2002 DoD budget request. House authorizers reported reducing the overall funding for the V-22 program by \$264.7 million. The HASC matched the Administration's request for: \$1 billion to procure 12 MV-22s, \$96.7 million for Special Operations Command CV-22 component development, and \$10 million for Air Force CV-22 avionics development. House Authorizers reported reducing the Administration's request for: Navy RDT&E (-\$100 million), Air Force CV-22 procurement (-\$136.5 million), and Special Operations CV-22 procurement (-\$28.2 million).

In S.Rept. 107-62 (S. 1416), dated September 12, 2001, the Senate Armed Services Committee (SASC) provided their oversight of the V-22 program. In terms of research and development, the SASC, and HASC were largely in agreement. Like the HASC, the SASC matched the Air Force's request for CV-22 RDT&E. The SASC reduced the Navy's RDT&E request by \$95 million. The SASC and HASC were also largely in agreement regarding Air Force procurement, as the SASC zeroed out funds for procuring the CV-22, except for \$295 million for spare and repair parts. The biggest difference between the authorizing committees was that the SASC reduced the Navy's procurement request, authorizing \$783 million to procure nine Ospreys. Senate authorizers supported the Blue Ribbon Panel's recommendation that until the V-22 program resolves reliability and maintainability problems, "the V-22 program should not move forward faster than the minimum sustaining production rate."¹⁸

In their report to accompany S. 1438 (H.Rept. 107-333), FY2002 authorization conferees cut \$50 million from the Navy's procurement request, providing enough funding

¹⁸ U.S. Senate, 107th Congress, 1st Session, National Defense Authorization Act for Fiscal Year 2002. S.Rept. 107-62 (S. 1416). September 12, 2001. p. 78.

for 11 airframes vs the 12 requested. House authorizers matched the Administration's request, Senate authorizers had cut \$226.7 million to procure nine airframes. Conferees rejected the Administration's request for Air Force procurement funding, reduced the Navy's request for R&D funding by \$100 million, and matched the Air Force's request for \$10 million in R&D funding.

Authorization conferees also required DoD (Sec. 124, p.514) to provide a report 30 days prior to any resumption of V-22 flight testing. The report will notify Congress of any waiver of any item capability or other requirement specified in the V-22 Joint Operational Requirements Document, along with justification for any such waiver. The report would also describe any hydraulics or flight control software deficiencies and corrective actions, action to implement the recommendations of the Senior Review Panel, and an assessment of the NASA report on tiltrotor aeromechanics.

The House Appropriations Committee recommended that until the V-22 program completes its restructuring, that the overall production rate should be held to no more than 11 aircraft per year. Accordingly, the committee cut \$219 million and three aircraft from the Navy's FY02 procurement request, and \$100 million from the Navy's R&D account. Senate appropriators increased the Air Force's CV-22 request by \$84 million to fund procurement of two aircraft, while zeroing out a \$15 million request for advanced procurement. This transfer of budgetary resources to the CV-22 was intended to enable DoD to commence and accelerate initial operational testing of the special operations variant.

In their report to accompany H.R. 3338 (S.Rept. 107-109), the Senate Appropriations Committee cut \$226.7 million and three aircraft from the Navy's FY02 procurement request and zeroed-out the Air Force's procurement request of \$95.1 million. Senate appropriators matched the Navy's RDT&E request, but denied the Air Force's \$10 million R&D request.

In their report on H.R. 3338 (H.Rept. 107-350), FY2002 appropriation conferees cut the Navy's procurement request by \$226 million, a reduction of three airframes. Like authorizers, appropriators rejected the Administration's request for Air Force procurement funding. However, appropriators increased Air Force R&D funding by \$180 million to produce 2 CV-22 EMD articles. \$100 million was cut from the Navy's R&D request.